

FOSSIL AND RECENT CYPRAEACEA (MOLLUSCA: GASTROPODA) OF NEW ZEALAND WITH DESCRIPTIONS OF NEW SPECIES

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Abstract. The superfamily Cypraeacea is represented in New Zealand by 4 families and 36 species. In the Triviidae, 20 fossil species of Eratoinae and 5 species of Triviinae have been recorded; only one triviid species is found living in New Zealand waters. The Cypraeidae number 5 fossil species two of which are described as new to science, and 2 Recent species are firmly established members of New Zealand's molluscan fauna. Ovulidae are represented by 2 fossil and 1 living species and only 1 species of Pediculariidae occurs living in northern New Zealand waters.

Superfamily CYPRAEACEA Rafinesque, 1815

1863. Triviacea Troschel, *Geb. Schnecken* 1:214.

1966. Triviacea Troschel, *Schilder, Veliger* 9(1): 31,33.

Family TRIVIIDAE Troschel, 1863

1932. Eratoidae *Schilder, Proc. Malac. Soc. Lond.* 20:46.

Shell small or very small, elongate-ovate, ovate or conical, sometimes inflated, aperture linear or oblique, central or lateral, dentate on both lips; spire immersed or projecting, fossula either connected to the dorsal wall or free. Smooth or sculptured with transverse ribs and granules, dorsum with or without a dorsal groove; periostracum and operculum absent.

The osphradium is bipectinate, pedal ganglia are ovoid and short, and the echinospira larva is well developed. The living animal extends the mantle over the shell and moves freely on the substratum; the siphon is distinct and sexes are separate. The marginal teeth of the radula are claw-like and simple, the inner marginal occasionally with a small denticle. Triviidae live on a coral and rock substratum.

Fretter and Graham (1962) assigned the Triviidae to the superfamily Lamellariacea d'Orbigny, while *Schilder* (1966) located the family in the superfamily Triviacea. In Lamellariacea the shell is sometimes internal, and when external it is ear-shaped, with a large aperture, a sharp labial lip and a smooth columella. Lamellariidae have a periostracum, a nautiloid echinospira larva, ovoid pedal ganglia, united jaws and no distinct siphon; species of one genus are hermaphrodite. Triviidae are more closely related to the Cypraeacea and differ from Cypraeidae and Ovulidae which have no echinospira larva, long pedal ganglia and a triradiate osphradium.

From a phylogenetic viewpoint, Eratoinae and Triviinae are closely related and the anatomy of both groups is also rather similar. Fretter & Graham (loc. cit.), Schilder (1966) and Cernohorsky (1968) have combined Eratoinae and Triviinae in one family.

Subfamily ERATOINAE Gill, 1871

1871. Eratoinae Gill. Smiths. Misc. Coll. 10(227) : 9.

1927. Eratoinae Schilder, Arch. Naturg. 91 : 1.

Shell small, biconic, marginellid in shape, spire broad and projecting, sometimes calloused, aperture more or less angulate, sometimes oblique. Smooth or sculptured with granules or short ribs and occasionally a dorsal groove; aperture moderately narrow, both lips dentate and shell outlets broad and shallow. Siphon separated by a rim and anterior margin of fossula free.

The subfamilial name Eratoinae should be credited to Gill (1871) and not Schilder.

Genus *Willungia* Powell, 1938

Willungia Powell, 1938, Trans. Proc. R. Soc. N.Z. 68(3) : 370. Type species by OD *W.tasmanica* Powell, 1938. L.Miocene of Tasmania, Australia.

Shell globular and inflated, protoconch with $1\frac{1}{2}$ whorls, spire depressed, labial varix calloused; aperture open, occasionally widening anteriorly, labial lip regularly convex and ribbed, columella with prominent ribs along its entire length, ribs extending onto body whorl. Columella excavated anteriorly and with a strong single terminal fold; fossula weak but broad and ridged.

Three New Zealand species are referable to this genus. *Willungia* is probably the most primitive eratoid and resembles to some extent *Eratotrivia* Sacco from the European Eocene, particularly the species *E.wetherellii* Edwards from the Lower Eocene of England. In *Eratotrivia*, however, the columellar ribs are continuous and encircling, and the anterior columellar projection is lacking.

Willungia erro (Laws, 1941)

(Fig. 1)

1941. *Eratopsis erro* Laws, Trans. Proc. R. Soc. N.Z. 71 (2) : 144, pl. 18, fig. 24.

1966. *Eratopsis erro* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Pakaurangi Point, Kaipara, (Otaian), L.Miocene.

This species is a typical *Willungia* although more slender than the type species.

Willungia fracta (Tomlin, 1916)

(Fig. 2)

1873. *Marginella ventricosa* Hutton, Cat. Tert. Moll. Echin. N.Z. p. 8 (non G. Fischer, 1807).

1916. *Marginella fracta* Tomlin, J. Conch. 15 : 43 (nom. subst. pro *M.ventricosa* Hutton, 1873).

1938. *Willungia fracta* (Tomlin), Powell, Trans. Proc. R. Soc. N.Z. 68 (3) : 371, pl. 39, figs. 6, 7 (Waiheke I., L. Miocene).



Figs. 1, 2. 1. *Willungia erro* (Laws). Pakaurangi Pt, L. Miocene; length 5.9mm. (from Laws, 1941, pl. 18, fig. 24). 2. *W. fracta* (Tomlin). Whitewater Creek, Trelissick Basin, U. Oligocene; length 18.0mm.

TYPE LOCALITY: Broken River, (Dunroonian), U.Oligocene.

Schilder (1961) suggested a placement of this species into *Archierato*. *Marginea fracta* is a *Willungia*, and in the figured specimen from Trelissick Basin, 8 plications are visible which cross the ventral side of the body whorl.

Willungia maoria Powell, 1938

1938. *Willungia maoria* Powell, Trans. Proc. R. Soc. N.Z. 68(3): 371, pl. 39, figs. 8,9.
1966. *Willungia maoria* Powell, Fleming, N.Z. Geol. Surv. Bull. No. 173: 53.

Schilder (1961) suggested that *Willungia maoria* be placed in *Archierato*. The holotype of *W.maoria* is indeed a *Willungia*, but due to breakage, fossilization and distortion, some characters may not be evident from the type figure. The labial denticles are elongated ridges, but due to distortion have been displaced deep into the aperture; possibly not being a fully developed individual or due to wear, the overlapping columellar ridges are not evident on the ventral side of the body whorl.

Genus **Lachryma** Sowerby [1832]

Lachryma Sowerby [1832]. Conch. Illust. Cat. Cypr., p. 15. Type species by T *Erato lachryma* Sowerby, [1832]. Recent, S.E. Australia.

1932. *Cypraerato* Schilder, Fossil. Cat. p. 86. Type species by OD *Erato bimaculata* Tate. 1878. Recent, Sth. Australia.

1935. *Eratoena* Iredale, Aust. Zool. 8: 97. Type species by OD *Ovulum corrugatum* Hinds, 1845 = *Erato sulcifera* Sowerby, [1832]. Recent, Indo-Pacific.

Shell very small, biconic, smooth or granulose, occasionally with a dorsal groove, spire broad and projecting, labial lip convex and slightly reflected; aperture lateral, narrow and oblique, lips dentate, posterior columellar denticles often obsolete, fossula moderately concave. Anterior of columellar lip with 2-3 stronger plications not separated from the columellar denticles. Unicoloured or banded, anterior extremity often violet.

The priority of the genus-group name *Lachryma* Sowerby over *Proterato* Schilder, has been discussed by the present author already (Cernohorsky 1968). Article 11(d) of the Code of I.C.Z.N. is quite explicit about names published in synonymy, and *Lachryma* is clearly an available and prior genus name since it has been treated as an available name with its original date and authorship prior to 1961 by several writers. The name *Lachryma* was used by Iredale (1931), Cotton & Godfrey (1932), Iredale (1935), Cotton (1958), Allan (1959) and Cotton (1959); after 1961 it has been used by Iredale & McMichael (1962) and Cernohorsky (1968).

Lachryma will replace *Proterato* Schilder as a genus, and will include Recent Indo-Pacific species previously placed in either *Sulcerato* Finlay or *Eratoena* Iredale. *Proterato* Schilder has been retained as a subgenus for a group of Eocene-Pliocene fossil species from New Zealand and Australia.

Subgenus **Proterato** Schilder, 1927

Proterato Schilder, 1927, Arch. Naturg. 91A : 57. Type species by OD *Erato neozelanica* Suter, 1917. L.Miocene of New Zealand.

1930. *Sulcerato* Finlay, Trans. Proc. N.Z. Inst. 61(1) : 40. Type species by OD *Erato (Eratopsis)illota* Tate, 1890. L.Pliocene of Victoria, Australia.

Species of *Proterato* differ from *Lachryma* s.str. only in the absence of surface sculpture and a slightly deeper and more produced fossula. Species of *Proterato* are confined to Eocene-Pliocene deposits of Australia and New Zealand.

Eocene species

Lachryma (Proterato) antiqua (Marshall, 1919)

1919. *Erato antiqua* Marshall, Trans. Proc. N.Z. Inst. 51 :227, pl. 15, fig. 7.

1933. *Archierato antiqua* Marshall, Schilder, Proc. Malac. Soc. Lond. 20 (5) : 260.

1935. *Erato antiqua* Marshall, Laws, Trans. Proc. Soc. N.Z. 65(1) : 18.

1941. *Proterato (Proterato) antiqua* Marshall, Schilder, Arch. Moll. 73 : 68.

1966. *Archierato antiqua* (Marshall), Fleming, N.Z. Geol. Surv. Bull. No. 173 :52.

TYPE LOCALITY: Hampden beds, Oamaru (Bortonian), M.Eocene.

The species was assigned to *Archierato* by Schilder (1933) on the basis of the poor type figure. Pertinent additions to the description by Laws (1935), i.e. the numerous labial denticles and 2 light folds on the anterior of the columella, exclude the species from *Archierato*. Species of the latter genus have a single prominent terminal ridge which is well separated from the preceding columellar denticles.

Lachryma (Proterato) seposita (Laws, 1935)

1935. *Erato sepositum* Laws, Trans. Proc. R. Soc. N.Z. 65 (1) : 22, pl. 3, fig. 8.

1941. *Proterato (Proterato) seposita* Laws, Schilder, Arch. Moll. 73 :69.

1966. *Proterato sepositum* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 :53.

TYPE LOCALITY: Greensands, McCullough's bridge, (Kaiatan), U.Eocene.

Lachryma (Proterato) vulcania (Marwick, 1926)

1926. *Erato vulcania* Marwick, Trans. Proc. N.Z. Inst. 56 : 314, pl. 72, fig. 25.
 1933. *Proterato (Proterato) vulcania* Marwick, Schilder, Proc. Malac. Soc. Lond. 20(5) : 248.
 1935. *Erato vulcania* Marwick, Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 19.
 1966. *Proterato vulcania* (Marwick), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53, pl. 90, fig. 1070.

TYPE LOCALITY: Lorne, near Oamaru, (Kaiatan), U.Eocene.

The species differs from other Eocene species by its pyriform shape and weakly developed labial denticles; the columellar teeth are also weak and confined to the anterior third of the columella.

Oligocene — Miocene species

Lachryma (Proterato) marshalli (Marwick, 1929)

1929. *Erato marshalli* Marwick, Trans. Proc. N.Z. Inst. 59(4) : 922, fig. 56.
 1933. *Proterato (Proterato) marshalli* Marwick, Schilder, Proc. Malac. Soc. Lond. 20(5) : 248.
 1935. *Erato marshalli* Marwick, Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 21.
 1941. *Proterato (Cypraeerato) marshalli* Marwick, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato marshalli* (Marwick), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52, pl. 90, fig. 1069.

TYPE LOCALITY: Chatton, 8 miles (12.8 km) N. of Gore, Southland, (Duntroonian), U.Oligocene.

Lachryma (Proterato) waitakiensis (Laws, 1935)

1935. *Erato waitakiensis* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 20, pl. 3, fig. 2.
 1941. *Proterato (Eratoena) waitakiensis* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato waitakiensis* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Otiake, (Waitakian), L.Miocene.

Lachryma (Proterato) neozelanica (Suter, 1917) (Fig. 3)

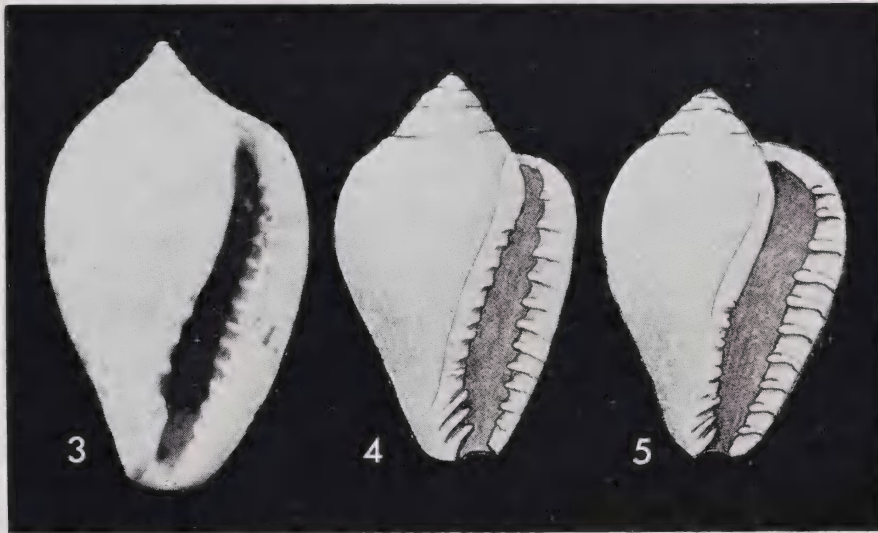
1917. *Erato neozelanica* Suter, N.Z. Geol. Surv. Pal. Bull. 5 : 12, pl. 3, figs. 6, 7.
 1933. *Proterato (Proterato) neozelanica* Suter, Schilder, Proc. Malac. Soc. Lond. 20 (5) : 247, 248. fig. 11.
 1935. *Erato neozelanica* Suter, Laws, Trans. Proc. R. Soc. N.Z. 65 (1) : 22.
 1966. *Proterato neozelanica* (Suter), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Target Gully, Oamaru, (Awamoan), L.Miocene.

This species is the type species of *Proterato* Schilder, 1927.

Lachryma (Proterato) senectus (Murdoch, 1924) (Fig. 5)

1924. *Erato senectus* Murdoch, Trans. Proc. N.Z. Inst. 55 : 160, pl. 10, figs. 5, 6.



Figs. 3-5. 3. *Lachryma (Proterato) neozelanica* (Suter). Devil's bridge, Oamaru, L. Miocene; length 14.6mm. 4. *L. (P.) awamoana* (Schilder) (= *senectus* Murdoch). Awamoia stream, near Oamaru, L. Miocene; length 11.0mm. (from Murdoch, 1924, pl. 10, fig. 4). 5. *L. (P.) senectus* (Murdoch). Target Gully, Oamaru, L. Miocene; length 4.5mm (from Murdoch, 1924, pl. 10, fig. 5).

- 1933. *Proterato (Cypraeerato) minor senectus* Murdoch, Schilder, Proc. Malac. Soc. Lond. 20(5) : 248, fig. 28.
- 1935. *Erato senectus* Murdoch, Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 19.
- 1951. *Proterato (Eratoena) senectus* Murdoch, Schilder, Arch. Moll. 73 : 69.
- 1966. *Proterato (Cypraeerato) senectus* (Murdoch), Fleming, N.Z. Geol. Surv. Bull. No. 173:53.

TYPE LOCALITY: Target Gully, Oamaru, (Awamoan), L.Miocene.

***Lachryma (Proterato) awamoana* (Schilder, 1933) (Fig. 4)**

- 1924. *Erato neozelanica* Murdoch, Trans. Proc. N.Z. Inst. 55 : 160, pl. 10, fig. 4 (non Suter, 1917).
- 1933. *Proterato (Proterato) awamoana* Schilder, Proc. Malac. Soc. Lond. 20(5) : 248, 260, fig. 10 (nom. nov. pro. *Erato neozelanica* Murdoch, 1924).
- 1941. *Proterato awamoana* Schilder, Arch. Moll. 73: 69.
- 1966. *Proterato awamoana* Schilder, Fleming, N.Z. Geol. Surv. Bull. No. 173: 52.

TYPE LOCALITY: Awamoia stream, near Oamaru, (Awamoan), L.Miocene.

This species appears to be a synonym of *L.(P.) senectus* (Murdoch) from the same horizon, and differs only in being larger in size (type of *senectus* 4.5 mm, type of *awamoana* 11.0mm). The figured type of *L. (P.) awamoana* has 3-4 more labial denticles, but this particular character is variable in Eratoinae; in his description of *L. (P.) senectus*, Murdoch (1924) described the labial lip as having few or numerous denticles. Despite the two species close specific resemblance, Schilder (1933) assigned *L. (P.) senectus* to the subgenus *Cypraeerato* and *L. (P.) awamoana* to the subgenus *Proterato*; in 1941 that author transferred *L. (P.) senectus* to the subgenus *Eratoena*.

Lachryma (Proterato) submorosa (Laws, 1935)

1935. *Erato submorosa* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 20, pl. 3, fig. 4.
 1941. *Proterato (Eratoena) submorosa* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato (Cypraerato) submorosa* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Pukeuri, (Awamoan), L.Miocene.

Lachryma (Proterato) pukeuriensis (Laws, 1935)

1935. *Erato pukeuriensis* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 21, pl. 3, fig. 6.
 1941. *Proterato (Proterato) pukeuriensis* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato pukeuriensis* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Pukeuri, (Awamoan), L.Miocene.

Lachryma (Proterato) tenuilabrum (Laws, 1935)

1935. *Erato tenuilabrum* Laws, Trans. Proc. R. Soc. N.Z. 65 (1) : 21, pl. 3, fig. 5.
 1941. *Proterato (Proterato) tenuilabrum* Laws, Schilder, Arch. Moll. 73 : 69.

TYPE LOCALITY: Clifden, Southland, band 6C, M.Miocene.

This may be a synonym of *L. (P.) pukeuriensis*. The differences noted by Laws (1935), i.e. more excavated columella and a more squat body whorl, point to an immature specimen.

Lachryma (Proterato) waiauensis (Laws, 1935)

1935. *Erato waiauensis* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 22, pl. 3, fig. 7.
 1941. *Proterato (Proterato) waiauensis* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato waiauensis* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Clifden, Southland, beds A and C. M.Miocene.

Lachryma (Proterato) clifdenensis (Laws, 1935)

1935. *Erato clifdenensis* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 20, pl. 7, fig. 3.
 1941. *Proterato (Eratoena) clifdenensis* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Proterato clifdenensis* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.

TYPE LOCALITY: Clifden, Southland, band 7, (Lillburnian), M.Miocene.

*Pliocene species***Lachryma (Proterato) pliocenica** (Fleming, 1943)

1943. *Proterato pliocenica* Fleming, Trans. Proc. R. Soc. N.Z. 73(3) : 196, pl. 29, fig. 10.
 1966. *Proterato pliocenica* Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Takapau S.D., (Waitotaran), U.Pliocene.

This species is the youngest *Proterato* on record from New Zealand.

Genus **Archierato** Schilder, 1932

Archierato Schilder, 1932, Fossil. Cat., p. 82. Type species by OD *Erato pyrulata* Tate, 1890. Aldingian and Adelaide bore, U.Eocene of Sth. Australia.

Shell more inflated and pear-shaped than *Proterato*, sometimes globular, extremities more rounded, spire hidden or visible, labial denticles generally coarser, posterior columellar teeth obsolete, anterior ones small; base of columella with a single, strong terminal fold, fossula concave, often narrow.

The shell figured by Powell (1938) as *Cypraea ovulatella* Tate, from the Aldingian Eocene of South Australia, appears to be a variant of *Archierato pyrulata* (Tate, 1890) in which the labial teeth are more distant. The actual *Cypraea ovulatella* Tate belongs to the cypraeid genus *Austrocypraea* Cossman; the species has been figured by Schilder (1935).

Archierato accola (Laws, 1935)

1935. *Erato accola* Laws, Trans. Proc. R. Soc. N.Z. 65(1) : 18, pl. 3, fig. 1.
 1941. *Archierato accola* Laws, Schilder, Arch. Moll. 73 : 70.
 1966. *Archierato accola* (Laws), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.

TYPE LOCALITY: McCullough's bridge, (Kaiatan), U.Eocene.

Archierato simulacrum Laws, 1939

1939. *Archierato simulacrum* Laws, Trans. Proc. R. Soc. N.Z. 68(4) : 490, pl. 64, fig. 36.
 1941. *Proterato (Eratoena) simulacrum* Laws, Schilder, Arch. Moll. 73 : 69.
 1966. *Archierato simulacrum* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.

TYPE LOCALITY: Pakaurangi Point, Kaipara, (Otaian), L.Miocene.

Archierato zepyrulata Laws, 1939

(Fig. 6)

1939. *Archierato zepyrulata* Laws, Trans. Proc. R. Soc. N.Z. 68(4) : 490, pl. 64, fig. 35.
 1941. *Archierato zepyrulata* Laws, Schilder, Arch. Moll. 73 : 69.
 1941. *Hespererato zevitellina* Laws, Trans. Proc. R. Soc. N.Z. 71(2) : 144, pl. 19, fig. 37.
 1966. *Archierato zepyrulata* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.
 1966. *Hesperato* (sic) *zevitellina* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 53.

TYPE LOCALITY: Pakaurangi Point, Kaipara, (Otaian), L.Miocene (*zepyrulata* and *zevitellina*).

The present author agrees with Schilder's (1961) suggestion that *A.zevitellina* and *A.zepyrulata* are the same species represented by specimens in different developmental stages. Not fully developed species of Eratoinae often have an obsolete fossula, a feature which prompted Laws (1941) to associate his species with the European-Caribbean *Hespererato*, a group of species with an almost obsolete fossula but prominently denticulate lips.



Fig. 6. *Archierato zevitellina* (Laws) (= *zephyrulata* Laws). Pakaurangi Pt, L. Miocene; length 5.1mm. (from Laws, 1941, pl. 19, fig. 37).

Subfamily TRIVIINAE Troschel, 1863

Shell ovate or rounded, often inflated, sculptured with transverse dorsal ribs extending onto the base and into the aperture; the dorsal ribs either continuous or interrupted by a dorsal groove. Spire broad, slightly protruding or covered in adult specimens with the exception of *Semitrivia* Cossmann, aperture linear, lateral or central, sometimes wide, both lips denticulate; the columella generally extending deep into the aperture, but projecting in *Semitrivia*.

Genus *Ellatrivia* Iredale, 1931

Ellatrivia Iredale, 1931, Rec. Austral. Mus. 18 (4) : 221. Type species by OD *E. merces* Iredale = *Triviella merces* Iredale, 1924. Recent, S.E. Australia.

Shell small, ovate or elongate-ovate, sculptured with transverse ribs, ribs continuous or interrupted by a broad and concave or narrow and shallow dorsal groove; extremities blunt, spire covered or slightly projecting, aperture moderately narrow or wide, lateral, somewhat curved, fossula moderately broad.

Generic differences between *Niveria* Jousseume, 1884, *Cleotrivia* Iredale, 1930, *Fossatrivia* Iredale, 1931 and *Ellatrivia* Iredale are often nebulous, and some of the generic diagnostic characters are often of only specific or even ecophenotypic value. The differences in juvenile and adult specimens of the same species are often pronounced to such a degree as to warrant inclusion of specimens of a species in separate genera.

Schilder (1935) suggested that *Fossatrivia* Iredale be regarded as a subgenus of *Semitrivia* Cossmann, and *Ellatrivia* was accorded full generic rank by the same author. In his subsequent work on the Cypraeacea (1941), Schilder treated *Ellatrivia* as a subgenus of *Niveria* and *Fossatrivia* was given full generic rank.

The New Zealand fossil and Recent Triviinae are all assignable to *Elle-*

trivia. The Eocene species *E.pinguior* (Marwick) has a straighter aperture than is usual in *Ellatrivia*.

***Ellatrivia pinguior* (Marwick, 1926)**

1926. *Trivia pinguior* Marwick, Trans. Proc. N.Z. Inst. 56 : 314, pl. 72, figs. 14,15.
 1941. ?*Fossatrivia pinguior* Marwick, Schilder, Arch. Moll. 73 : 72.
 1966. *Trivia pinguior* Marwick, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52, pl. 90.

TYPE LOCALITY: Lorne, Oamaru, (Kaiatan), U.Eocene.

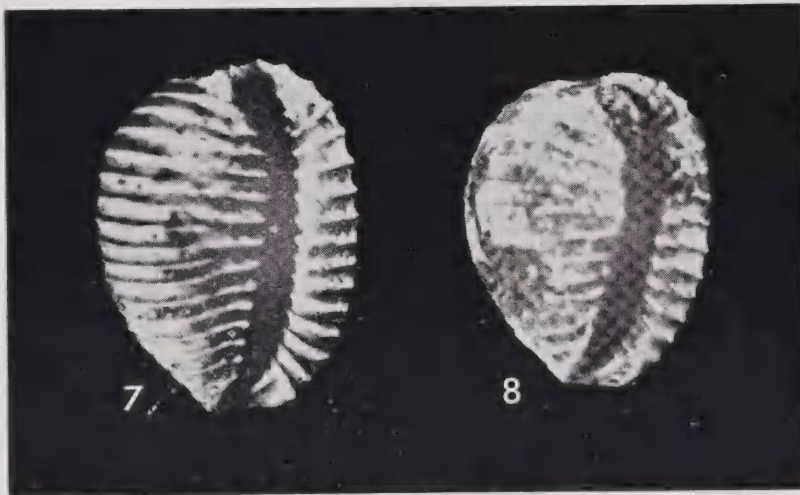
***Ellatrivia kaiparaensis* Laws, 1939**

(Figs. 7,8)

1918. *Trivia avellanioides* (sic) McCoy, Marshall, Trans. Proc. N.Z. Inst. 50 : 273 (non *Cypraea (Trivia) avellanioides* McCoy, 1867).
 1939. *Ellatrivia kaiparaensis* Laws, Trans. Proc. R. Soc. N.Z. 68 (4) : 489, pl. 64, figs. 26, 28,31.
 1941. *Niveria (Ellatrivia) kaiparaensis* Laws, Schilder, Arch. Moll. 73 : 75.
 1941. *Trivia aequiflora* Laws, Trans. Proc. R. Soc. N.Z. 71(2) : 144, pl. 19, figs. 44,49.
 1966. *Ellatrivia kaiparaensis* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.
 1966. *Trivia aequiflora* Laws, Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.

TYPE LOCALITY: Pakaurangi Point, Kaipara, (Otaian), L.Miocene (*kaiparaensis* and *aequiflora*).

Schilder (1961) considered *Trivia aequiflora* to be an immature specimen of *Ellatrivia kaiparaensis*. The more bulbous form, projecting spire, slightly wider aperture and not fully developed terminal ridge of the type specimen of *Trivia aequiflora* are characteristic features of immaturity in Triviinae. In this particular case, the changing developmental stage characters have been interpreted as generic characters, and one species was assigned to *Ellatrivia* and the other to *Trivia*.



Figs. 7, 8. 7. *Ellatrivia kaiparaensis* Laws. Pakaurangi Pt. L. Miocene; length 5.0mm. (from Laws, 1939, pl. 64, fig. 26). 8. *E. aequiflora* Laws) (= *kaiparaensis* Laws). Pakaurangi Pt., L. Miocene; length 3.7mm (from Laws, 1941, pl. 19, fig. 49).

Ellatrivia flora (Marwick, 1928)

1928. *Trivia flora* Marwick, Trans. Proc. N.Z. Inst. 58(4) : 482, figs. 118, 119.
 1941. *Niveria (Ellatrivia) flora* Marwick, Schilder, Arch. Moll. 73 : 75.
 1966. *Trivia flora* Marwick, Fleming N.Z. Geol. Surv. Bull. No. 173 : 52, pl. 90, figs. 1071, 1072.

TYPE LOCALITY: Flower-pot Harbour, Pitt I., Chatham Islds., (Opoitian), L. Pliocene.

Ellatrivia zealandica (Kirk, 1882)

(Fig. 9)

1882. *Trivia zealandica* Kirk, Trans. Proc. N.Z. Inst., 14 : 409.
 1893. *Trivia neozelanica* Kirk, Hutton, Macleay Mem. vol. Linn. Soc. N.S.W., p. 58 (*nom. null.*).
 1915. *Trivia zealandica* Kirk, Suter, N.Z. Geol. Surv. Pal. Bull. 3 : 11, pl. 8, figs. 3a, b.
 1966. *Ellatrivia zealandica* (Kirk), Fleming, N.Z. Geol. Surv. Bull. No. 173 : 52.

TYPE LOCALITY: Petane, Hawke's Bay, (Nukumaruan), L. Pleistocene.

In his original description, Kirk (1882) omitted to mention important diagnostic features of his new species, and no figure was appended. Suter (1915) announced the loss of Kirk's holotype of *E. zealandica*, and designated an incomplete and damaged specimen as the neotype of *Trivia zealandica*. Since two species of *Ellatrivia* occur in the Lower Pleistocene deposits at Petane, it is not certain which species Kirk originally diagnosed; the neotype of *Trivia zealandica*, however, appears to be a distinct species from *Ellatrivia merces* which also occurs at Petane. The specimen which is figured here, and which the present author believes is the *Trivia zealandica* Kirk as represented by the neotype, differs from *Ellatrivia merces* in the following features: it is more pyriform, the dorsum is more conoidal than flat, the aperture is very narrow and the labial teeth are fewer and more widely spaced; the carinated labial margin is weak and the interspaces of the dorsal ribs are wide and distinctly finely granulose near the margin. The figured specimen is 8.4 mm long, the width-ratio is 74% of length and the height-ratio 60% of length; there are 16 teeth on both lips.

Ellatrivia merces (Iredale, 1924)

(Figs. 10-12)

1822. *Cypraea australis* Lamarck, Hist. Nat. anim. s. vert. 7 : 404 (non Schröter, 1804).
 1833. *Trivia australis* Lamarck, Quoy & Gaimard, Voy. Astrolabe 3 : 48, pl. 48, figs. 19-26 (non Schröter) 1804.
 1846. *Cypraea australis* Lamarck, Reeve, Conch. Icon, pl. 24, fig. 138 (non Schröter, 1804).
 1924. *Triviella merces* Iredale, Proc. Linn. Soc. N.S.W. 49(3) : 257, pl. 35, figs. 16, 17.
 1927. *Triviella memorata* Finlay, Trans. Proc. N.Z. Inst. 57 : 396, pl. 21, fig. 73 (March).
 1927. *Triviella maoriensis* Mestayer, Proc. Malac. Soc. Lond. 17 : 186, figs. 3, 4 (December).
 1931. *Ellatrivia (merces) addenda* Iredale, Rec. Aust. Mus. 18(4) : 221 (*nom. nud.* — no description or figure).

TYPE LOCALITY: Port Jackson, N.S.W., Australia (*merces*); New Holland (*australis*); Ahipara Bay near Auckland, New Zealand (*memorata*); Reef Point, Ahipara Bay, New Zealand (*maoriensis*).



Figs. 9-12. 9. *Ellatrivia zealandica* (Kirk). Topotype from Petane, Hawke's Bay, L. Pleistocene; AIM-6105; length 8.4mm, width 6.3mm. 10, 10a. *E. merces* (Iredale). Petane, Hawke's Bay, L. Pleistocene; Powell coll.; length 11.9mm, width 8.1mm. 11. *E. merces* (Iredale). Takau Bay, New Zealand; Powell coll. No. 42751; length 13.0mm, width 9.5mm. 12. *E. merces* (Iredale). Shellharbour, N.S.W., Australia; Powell coll. No. 5329; length 12.8mm, width 8.8mm.

Finlay (1927) separated the New Zealand population of *Ellatryvia merces* from the Australian population of the species because shells from New Zealand were "shorter, higher, and more globose, with larger colour patches and less produced outer lip". Seventy-one Australian and 124 New Zealand specimens of *E. merces* were examined, and characteristics used by Finlay (loc. cit.) in differentiating his new species have been tabulated (Tables 1 and 2). It was found that the largest Australian specimen examined exceeded the largest New Zealand specimen by only 0.7 mm, and that neither population was more globose or had a higher dorsum than the other. The colour patches were found to be variable in both populations, and several New Zealand specimens had smaller colour blotches than Australian specimens. The width of the labial lip was found to be the same in both populations, and existing differences in the width of the labial lip were confined only to young and mature shells of both populations.

In the tables which follow (Tables 1,2), the width-ratio = $\frac{\text{Width}}{\text{length}}$ x 100 and the height-ratio = $\frac{\text{height}}{\text{length}}$ x 100; the number of teeth quoted is the actual number of teeth counted. The figured Pleistocene specimen of *E. merces* from Petane, has retained the rosy colour patches on the dorsum.

Table 1. Australian populations of *Ellatryvia merces* (Iredale).

No. of specimens	Length of shell (mm)	Width in % of length	Height in % of length	No. of labial teeth	No. of columellar teeth	Locality
46	9.0 - 14.3	64 - 75	52 - 61	20 - 27	16 - 23	Shellharbour, N.S.W.
4	9.9 - 14.0	67 - 71	51 - 56	21 - 28	18 - 22	Long Bay, N.S.W.
6	8.5 - 14.4	70 - 73	55 - 57	21 - 26	16 - 20	Victoria
8	14.3 - 15.7	66 - 69	54 - 58	23 - 28	19 - 22	Swansea, Tasmania
7	9.8 - 12.0	67 - 71	54 - 58	22 - 26	17 - 20	nr Fremantle, W.A.
71	8.5 - 15.7	64 - 75	51 - 61	20 - 27	16 - 23	Range of 71 specimens

Table 2. New Zealand populations of *Ellatryvia merces* (Iredale).

No. of specimens	Length of shell (mm)	Width in % of length	Height in % of length	No. of labial teeth	No. of columellar teeth	Locality
15	11.1 - 14.0	70 - 77	59 - 63	22 - 25	16 - 21	Ahipara (type locality)
70	9.0 - 14.3	66 - 75	55 - 62	20 - 26	16 - 21	Cape Maria van Diemen
2	9.3 - 11.5	69 - 70	56 - 57	23 - 26	17 - 20	Taranga, Hen Is.
1	13.4	68	56	23	22	Tairua
20	9.3 - 13.8	65 - 75	53 - 60	22 - 26	17 - 20	Takau Bay
3	7.9 - 15.0	69 - 73	59 - 60	21 - 24	16 - 19	Chatham Islands
5	9.0 - 13.0	69 - 72	57 - 61	20 - 24	15 - 21	Mt Maunganui
3	11.0 - 12.9	70 - 72	55 - 57	22 - 25	18 - 20	Whangaroa
3	10.6 - 12.8	68 - 72	58 - 60	24 - 26	18 - 22	Whangarei Heads
2	11.9 - 14.0	69 - 75	58 - 59	21 - 23	17 - 20	Petane, L. Pleistocene
124	7.9 - 15.0	65 - 77	53 - 63	20 - 26	15 - 22	Range of 124 specimens

*Erroneous Record***Triviella gamma** Mestayer, 1927

1927. *Triviella gamma* Mestayer, Proc. Malac. Soc. Lond. 17:188, fig. 5.

TYPE LOCALITY: Bay of Islands, New Zealand (error!).

The species figured by Mestayer (1927) is obviously the Caribbean species *Niveria pediculus* (Linnaeus, 1758) and the paratype which has been examined is the same species. Finlay (1930) excluded this species from the New Zealand fauna, and remarked that Miss Mestayer received these shells from Suter, who in turn obtained them by exchange.

Family PEDICULARIIDAE H. & A. Adams, 1854

Genus **Pedicularia** Swainson, 1840

Pedicularia Swainson, 1840, Treat. Malac., pp. 244, 357. Type species by M. *P. sicula* Swainson, 1840. Recent, Mediterranean.

1844. *Thyreus* Philippi, Enum. Moll. Sic., 2:92. Type species by M. *T. paradoxus* Philippi, 1844 = *Pedicularia sicula* Swainson, 1840.

1925. *Pediculariella* Thiele in Kückenthal, Handb. Zool. 5:88. Type species by OD *Pedicularia californica* Newcomb, 1865. Recent, W. coast America.

1935. *Pediculariona* Iredale, Aust. Zool. 8:101. Type species by OD *Pedicularia stylasteris* Hedley, 1903 = ?*P. pacifica* Pease, 1865. Recent, Pacific.

Shell small, cap-shaped, unicoloured, with a flaring margin, dorsum striate, interstices minutely granulose; lips sharply edged, spire covered or projecting.

Pedicularia pacifica Pease, 1865

1865. *Pedicularia pacifica* Pease, Proc. Zool. Soc. Lond. p. 516.

1868. *Pedicularia pacifica* Pease, Amer. J. Conch. 4:96, pl. 11, figs. 17, 18.

1903. ?*Pedicularia stylasteris* Hedley, Mem. Aust. Mus. 4:342, figs. 69, 70.

1937. *Pedicularia maoria* Powell, Discovery Repts. 15:208, pl. 54, figs. 13, 14.

1944. *Pedicularia pacifica* Pease, Schilder, Ark. Zool. 36A:29 (animal, radula, veligers).

1965. *Pedicularia pacifica* Pease, Kay, Bull. Brit. Mus. (Nat. Hist.) Zool. Suppl. 1:84, pl. 14, figs. 13, 14 (figd. lectotype).

TYPE LOCALITY: Apaian Isld. (= Abaiang I., Gilbert Islands) (*pacifica*); off Three Kings Islands, New Zealand, in 260 metres (*maoria*).

The New Zealand *P. maoria* is a typical *P. pacifica* Pease. The sculpture of alternating spiral threads and concentric striae and the excavated columella with the inner margin carinate are typical features of *P. pacifica*. In *P. pacifica* the spire is either visible or covered and in adult specimens the columella is edentulous. Young specimens are denticulate on the columella and in some mature specimens the radial ribs are visible in the centre of the columella.

Family CYPRAEIDAE Rafinesque, 1815

(= Porcellanidae Roberts, 1870)

Subfamily BERNAYINAE Schilder, 1927

(= Cypraeorbinae Schilder, 1927, = Zoilinae Iredale, 1935)

Genus **Bernaya** Jousseume, 1884

Bernaya Jousseume, 1884, Bull. Soc. Zool. France 9:88. Type species by SD (Jousseume, 1884) *Cypraea media* Deshayes, 1835. Eocene of Paris Basin, France.

Shell moderate in size, 20-50 mm in length, canals short, spire covered, sides rounded, base convex and concave anteriorly; labial lip broad, aperture moderately wide, labial teeth somewhat produced, fossula broad, smooth and concave, columella smooth and without a groove.

Bernaya zoiloides Schilder, 1958

1934. *Cypraea* sp. Ferrar, N.Z. Geol. Surv. Bull. No. 34:36 (Pahi Peninsula [*vide* Fleming, 1950]).

1950. *Cypraea* (?*Bernaya*) n.sp. Fleming, Trans. Proc. R. Soc. N.Z. 78:249, fig. 1d.

1958. *Bernaya zoiloides* Schilder, Arch. Moll. 87:179 (*nom. nov. pro Cypraea* (?*Bernaya*) sp. Fleming, 1950).

TYPE LOCALITY: Pahi greensands, North Auckland, (Bortonian), M.Eocene.

Bernaya chathamensis sp.n.

(Fig. 13)

Shell moderate in size, 35.8 mm in length, rounded and broad, posterior extremity short, anterior extremity only slightly produced, spire short and covered. Sides rounded, labial margin dimpled, base convex but concave anteriorly, labial lip moderately broad and declivious anteriorly, aperture widening anteriorly but narrow and curved posteriorly, posterior canal deep. Labial teeth slightly produced, columellar teeth short, confined to the aperture and not extending on to the columella; terminal ridge merging, columella smooth and without a sulcus, fossula broad, concave, smooth and projecting. *Holotype measurements*: Length 35.8 mm; width 27.3 mm; height 21.1 mm; number of labial teeth 18, of columellar teeth 14.

Location of holotype: Holotype No. TM-1325 in the Auckland Institute & Museum, Auckland, ex-A.Watherspoon.

TYPE LOCALITY: Flower-pot Harbour, Pitt Island, Chatham Islands, (Opoitian), L.Pliocene.

The new species bears no resemblance to any other New Zealand Cypraeidae nor to the larger species of the closely related *Zoila* Jousseume, from Australian Tertiary deposits. Living *Zoila* species are confined to the South and West Australian region and one *Bernaya* species survives in West Australian waters. It appears that *Bernaya* became extinct in New Zealand in comparatively recent times.

Bernaya chathamensis was found to be associated in the Flower-pot Harbour deposits with *Olivella neozelanica* (Hutton), a species which does not appear to

have been recorded from older deposits than Waitotaran, Upper Pliocene. The other species occurring in the same deposits is the volutomitrid *Waimatea costulosa* (Marwick), which has previously been recorded from the Opoitan, Lower Pliocene deposits.



Figs. 13, 14. 13. *Bernaya chathamensis* sp. n. Flower-pot Harbour, Pitt I., Chatham Islands; holotype AIM No. TM-1325; length 35.8mm, width 27.3mm. 14. *B. ficoides* (Hutton). Kakanui Tuffs, North Otago, L. Oligocene; AIM No. 8995; length 33.1mm. 14a. Spire view of specimen 30.5mm in length from the same locality.

Bernaya ficoides (Hutton, 1873)

(Figs. 14-15)

1873. *Volvaria ficoides* Hutton, Cat. Tert. Moll. Echin. N.Z., p. 8.1915. *Cypraea ficoides* (Hutton), Suter, N.Z. Geol. Surv. Pal. Bull. No. 3: 11, pl. 1, fig. 2 (28 x 21 mm).1941. *Notoluponia ficoides* (Hutton), Schilder, Arch. Moll. 73: 95.1966. *Cypraea ?ficoides* (Hutton), Fleming, N.Z. Geol. Surv. Bull. No. 173: 52.

TYPE LOCALITY: Oamaru, Tertiary of New Zealand.

Shell moderate in size, 25-52mm, broad and high, width 71%-81% of length (75% in type specimen), rounded, extremities short; the spire prominent but not projecting, 12.0 mm wide, consisting of 3-3½ turns. Sides rounded, labial lip keeled and base distinctly convex. Aperture narrow, curved anteriorly, labial teeth number 25-27, and columellar teeth 24.

Three specimens from the Kakanui Tuffs, N. Otago, (L.Oligocene) were laterally compressed through fossilization. The dimensions of these three specimens are



Fig. 15. *Bernaya ficoides* (Hutton). Ngahararu Point, Parengarenga Harbour, L. Miocene. Geol. Dept. Univ. Auckl.; length 49.5mm.

as follows: length, 33.0 mm, width 25.0 mm; length 30.3 mm, width 23.7 mm; length 25.4 mm, width 18.0 mm.

A specimen from muddy sandstone beds at Ngahararu Point, Parengarenga Harbour (L.Miocene), was in almost perfect condition; the length of this particular specimen was 49.5 mm, the width 40.0 mm and the height 34.2 mm, with 27 labial teeth and 24 columellar teeth. An internal cast of another specimen c. 52.0 mm in length, showed 25 labial and 24 columellar teeth.

The specimen from Parengarenga Harbour bears a close resemblance to a specimen of *Bernaya obesa* Deshayes, from Persia, as figured by Schilder (1941, pl.8, fig.8); in this particular specimen the spire is also exposed, 11.0 mm wide, and the labial lip is longitudinally keeled.

Subfamily CYPRAEINAE Rafinesque, 1815

(= Talpariini Schilder, 1936, = Mauritiinae Steadman & Cotton, 1946)

Genus, *Lyncina* Troschel, 1863

Lyncina Troschel, 1863, Geb. Schnecken 1:208. Type species by SD (Tryon, 1883) *Cypraea lynx* Linnaeus, 1758. Recent, Indo-Pacific.

Shell moderate in size, ovate to cylindrical, rarely pyriform, sides margined or rounded, base flat or convex; aperture straight and narrow, teeth numerous and close-set, lighter than interstices, columellar groove distinct.

Lyncina vitellus (Linnaeus, 1758)

1758. *Cypraea vitellus* Linnaeus, Syst. Nat. ed. 10, pl. 721.

1931. *Mystaponda orcina* Iredale, Rec. Aust. Mus. 18(4): 220, pl. 24, figs. 9,10 (N.S.W.).

1938. *Cypraea (Lyncina) vitellus polynesiae* Schilder & Schilder, Proc. Malac. Soc. Lond. 23(4): 187.

1967. *Lyncina vitellus* (Linnaeus), Powell, Rec. Auckland Inst. Mus. 6 (3) 185, pl. 36, figs. 1-3.

TYPE LOCALITY: Sunda Islands, Indonesia.

The species is known only from the Poor Knights Islands, where several specimens have been taken by divers at a depth of 60 - 100 feet (20 - 33 m). Names bestowed on Indian Ocean populations and ecophenotypic variants of the species, have been omitted from the synonymy.

Subfamily PUSTULARIINAE Gill, 1871

(= Erosariinae Schilder, 1924, = Nariinae Schilder, 1932)

Genus *Erosaria* Troschel, 1863

Erosaria Troschel, 1863, Geb. Schnecken, 1: 210. Type species by SD (Jousseume, 1884) *Cypraea erosa* Linnaeus, 1758. Recent, Indo-Pacific.

Shell moderate in size, ovate to pyriformly-ovate, sides margined and pitted, spire short, aperture narrow, dilated anteriorly; teeth strong, coarse and produced on labial lip but confined to the aperture or the columella, canals narrow and deep. Fossula moderately narrow, columella smooth and without a groove.

Erosaria cernica tomlini Schilder, 1930

1930. *Erosaria cernica tomlini* Schilder, Proc. Malac. Soc. Lond. 19:51.

1965. *Erosaria cernica tomlini* Schilder, Powell, Rec. Auckland Inst. Mus. 6(2):164, pl. 23, figs. 15-19.

TYPE LOCALITY: Lifu, Loyalty Islands.

Records are from Poor Knights Islands, 60-120 ft (20-30 m), and Cape Maria van Diemen, in beach debris.

Specimens from the Poor Knights Islands range of 27-31 mm in length and have a width-ratio of 64% - 68% of length; the width ratio coincides in morphometric characters with the Indian Ocean *E.cernica* s.str. (Schilder, 1930, gives the length of *E.cernica cernica* as 17-27 mm with a width-ratio of 61% - 75% and for *E.cernica tomlini* the length is given as 12-23 mm with a width ratio of 59% - 66%). The small and slender specimen from Cape Maria van Diemen has a width-ratio of 61% and agrees with the Pacific *E.cernica tomlini*. In some Poor Knights Islands specimens the dorsal spots are regular and the lateral spots sparse and nebulous, characters given by Schilder (loc. cit.) for the Indian Ocean *E.cernica*. Features of colour and width in relation to length in Cypraeidae are evidently influenced by ecological factors rather than geographic subspeciation, and of doubtful value in discriminating the Indian and Pacific Ocean populations of *E.cernica*.

To Powell's synonymic list (1965) should be added *Erosaria percomis* Iredale, 1931 (Sydney Harbour), *E.ogasawarensis* Schilder, 1944 (Bonin Islands), *E.tomlini maturata* Kira, 1959 (Ryukyu Islands) and *Cypraea cernica marielae* C. Cate, 1960 (Hawaiian Islands).

Subfamily ERRONEINAE Schilder, 1927

(= Cypraeovulidae Schilder, 1927)

Genus **Notoluponia** Schilder, 1935

Subgenus **Notadusta** Schilder, 1935

Notadusta Schilder, 1935, Proc. Malac. Soc. Lond. 21(6):350. Type species by OD *N.victoriana* Schilder, 1935. Miocene of Victoria, Australia.

Species of *Notadusta* differ from *Notoluponia* in features of a declivious labial lip in the anterior region, the prominent posterior canal and the smooth columella which is not crossed by the columellar teeth.

Notoluponia (Notadusta) trelissickensis (Suter, 1917) (Fig. 16)

1917. *Cypraea (Luponia) trelissickensis* Suter, N.Z. Geol. Surv. Pal. Bull. No. 5: 12, pl. 11, fig. 11.

1941. *Notadusta trelissickensis* Suter, Schilder, Arch. Moll. 73:98.

1966. *Cypraea (Luponia)? trelissickensis* (Suter), Fleming, N.Z. Geol. Surv. Bull. No. 173: 52.

TYPE LOCALITY: Whitewater Creek, Trelissick Basin, Canterbury, (Duntroonian), U.Oligocene.

There are 2 specimens of *N.trelissickensis* in the Finlay collection: one specimen c. 19.4 mm in length, with part of the anterior extremity missing, from the Kakanui Tuffs, N. Otago (Whaingaroan), Lower Oligocene, and a well preserved specimen from Pakaurangi Point, Kaipara, (Otaian), Lower Miocene. The Pakaurangi specimen measures 24.3 mm in length, 14.5 mm in width, labial teeth number 22 and columellar teeth 17; the first 5 anterior labial teeth are produced to the margin. The dorsum is humped, the labial side prominently margined and bent up, the labial lip is recurved towards the umbilicus which is covered; the columellar side is rounded and not margined and distinctly constricted anteriorly. The columellar teeth are confined to the aperture and do not extend over the columella as in *Notoluponia*, and both the fossula and columella are completely smooth; there is a single terminal ridge.



Fig. 16. *Notoluponia (Notadusta) trelissickensis* (Suter). Pakaurangi Pt, L. Miocene; AIM No. 8992; length 24.3mm, width 14.5mm.

The species extends from the Lower Oligocene to the Lower Miocene, and no distinguishing characters could be perceived in specimens from the older and younger deposits.

Notoluponia (Notadusta) clifdenensis sp.n.

(Figs. 17-18)

Shell moderate in size, 30-37 mm in length, elongate-ovate, sub-cylindrical, dorsum smooth; the labial lip margined, particularly at the extremities, and the columellar lip margined from the centre towards the anterior extremity. Aperture narrow, slightly recurved posteriorly, labial lip declivious anteriorly; the first five anterior teeth slightly produced but not reaching the margin, remainder of teeth short, columellar teeth small and confined to the aperture without extending over the columella. Posterior canal deep and well defined, columella smooth, fossula moderately broad, steep, smooth and not projecting; a single terminal ridge borders the anterior outlet, spire distinct and slightly projecting.

Holotype measurements: Length 37.0 mm; width 21.7 mm; height 19.0 mm; number of labial teeth 25; of columellar teeth 18.

Paratype measurements: Length 30.8 mm; width 18.0 mm; height 15.4 mm; number of labial teeth 25; of columellar teeth 15 + (lip incomplete).

TYPE LOCALITY: Clifden, band 6B, Southland, (Altonian), Mid-Miocene.

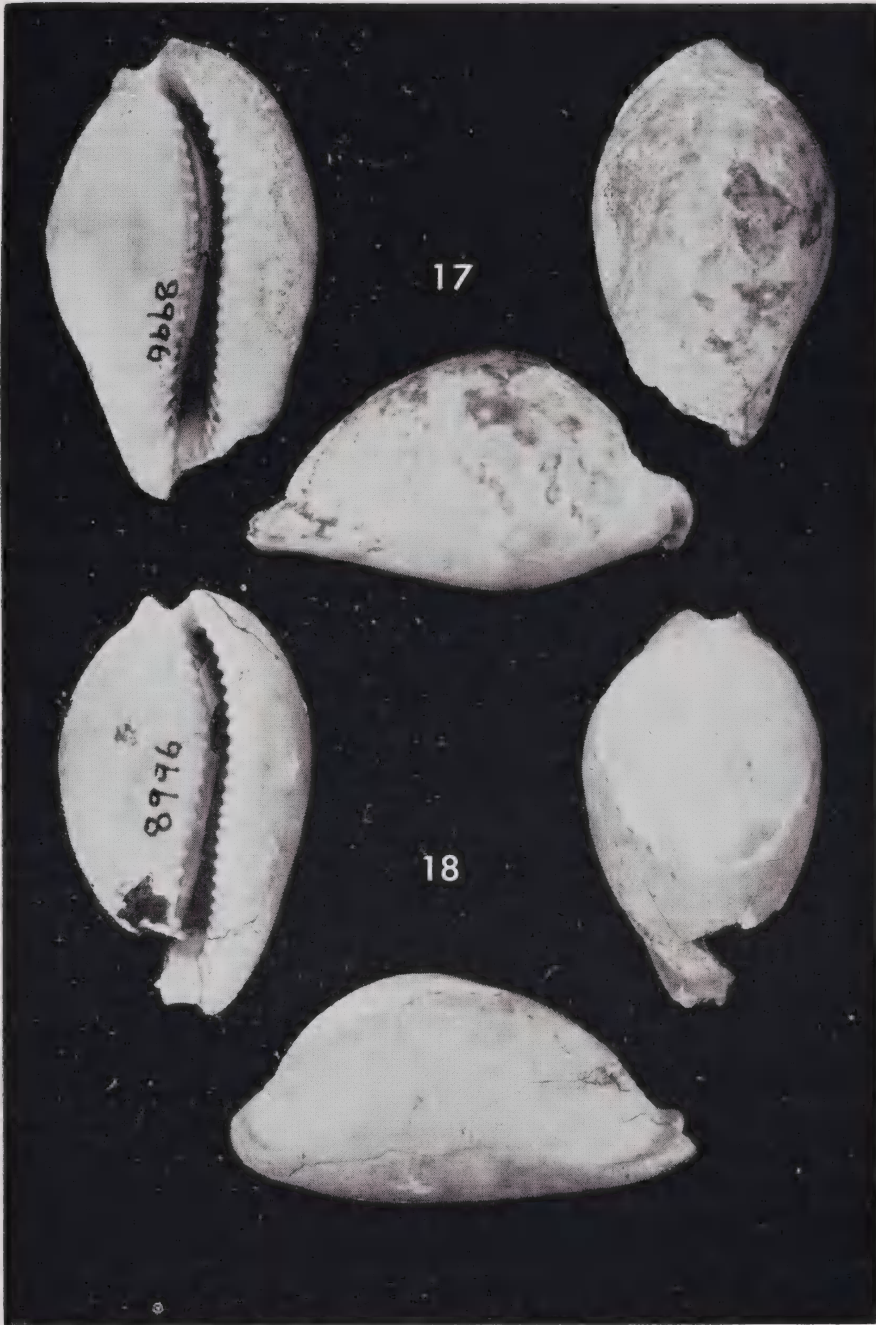
Location of types: Holotype No. TM-1324 and paratype No. TM-1324/1 in the Auckland Institute & Museum, Auckland, ex-Finlay collection.

N.clifdenensis differs from *N.trelissickensis* in being larger, more solid and not pyriform and having marginal pads at both sides of the anterior extremity instead being constricted; the labial lip is broader in *N.clifdenensis*, the labial teeth do not reach the margin anteriorly and the aperture is straighter and less curved posteriorly. The maximum height in *N.clifdenensis* is more towards the centre of the dorsum and not in the posterior third as in *N.trelissickensis* which is distinctly humped; the dorsum descends more steeply towards the anterior extremity in *N.trelissickensis* than in *N.clifdenensis*, and the spire is covered in the former but visible and projecting in the latter.

Notoluponia clifdenensis is closely related to *N.victoriana* (Schilder, 1935) from Muddy Creek, Victoria, Australia, but is twice as large, the fossula is steeper and completely smooth and not transversely ribbed or denticulate on the inner margin and the teeth are also shorter.

The two type specimens have been marked "*clifdenensis*" in a MS. note on the label, and Finlay's proposed but not published name has been retained for the new species.

?*Notadusta* n.sp. figured by Beu (1970, pl.4, fig.29) from Naakonui Stream, Wairapa, (Tongaporutuan), Upper Miocene, appears to be the same species as *N.clifdenensis*.



Figs. 17, 18. 17. *Notoluponia (Notadusta) clifdenensis* sp. n. Clifden, band 6B, Southland, M. Miocene; holotype AIM No. TM-1324 (old No. 8996); length 37.0mm, width 21.7mm. 18. Paratype from same locality, AIM No. TM-1324/1 (old No. 8996); length 30.8mm, width 18.0mm.

Family OVULIDAE Fleming, 1828

(= Amphiperasidae H. & A. Adams, 1854)

Subfamily EOCYPRAEINAE Schilder, 1924

(= Jenneriinae Thiele, 1929, = Sulcocypraeinae Schilder, 1932)

Shell moderately small, pyriform to ovate, spire involute, aperture narrow and curved posteriorly, denticulate on both lips, labial teeth not reaching the posterior canal. Fossula smooth, columella smooth or spirally striate and without a sulcus. Dorsum finely spirally but sometimes obsoletely striate, sides finely granulose.

Genus **Eocypraea** Cossmann, 1903

Eocypraea Cossmann, 1903, Ess. paléoc. comp. 5:162. Type species by OD *Cypraea inflata* Lamarck, 1802. Eocene of France.

Shell small, 20-30 mm in length, pyriform and inflated, anterior extremity produced, posterior extremity produced and curved, spire involute. Labial side weakly margined, columellar side rounded, anterior of labial lip declivious, aperture widening anteriorly; teeth small but developed on both lips, labial teeth not reaching posterior canal. Columella spirally striate and without a sulcus, fossula shallow, moderately broad and smooth. Dorsum finely and densely spirally striate, sides and base macroscopically granulose.

Eocypraea novaezealandiae (Schilder, 1941)

1921. *Cypraea* sp. Marshall & Murdoch, Trans. Proc. N.Z. Inst. 53: 81, pl. 18, fig. 6.

1941. *Notoluponia novaezealandiae* Schilder, Arch. Moll. 73:95 (*nom. nov. pro Cypraea* sp. Marshall & Murdoch, 1921).

1950. *Cypraea* (?*Eocypraea*) *murdochi* Fleming, Trans. Proc. R. Soc. N.Z. 78: 248, textfigs. 1a-c.

1966. *Cypraea* (*Eocypraea*) ?*murdochi* Fleming, N.Z. Geol. Surv. Bull. No. 173: 52.

TYPE LOCALITY: Pahi greensands, North Auckland, (Bortonian), Mid-Eocene.

Cypraea murdochi Fleming is an objective synonym of *E.novaezealandiae* (Schilder), as both taxa were based on the same type specimen. *Eocypraea* actually belongs to the Ovulidae and not the Cypraediae, but due to the bad preservation of the solitary type of *E.novaezealandiae* a location in *Eocypraea* is only tentative.

Subfamily OVULINAE Fleming, 1828

Shell small to moderate in size, pyriform to fusiform, dorsum frequently with a carina, extremities produced or beaked, spire involute; labial lip margined, columellar side rounded, aperture wide or narrow, teeth obsolete or absent. Fossula smooth, columella rounded, dorsum finely spirally striate, sides macroscopically granulose; generally unicoloured, occasionally with a single dorsal band.

Genus **Volva** Röding, 1798

Volva Röding, 1798, Mus. Bolten., p. 21. Type species by T *Bulla volva* Linnaeus, 1758. Recent Indo-Pacific.

1810. *Radius* Montfort, Conch. Syst. 2: 626. Type species by OD *Bulla volva* Linnaeus, 1758.
 1840. *Birostra* Swainson, Treat. Malac., p.325. Type species by M *Bulla volva* Linnaeus, 1758.

Subgenus **Phenacovolva** Iredale, 1930

Phenacovolva Iredale, 1930, Mem. Queensl. Mus. 10: 85. Type species by OD
P.nectarea Iredale, 1930 = *Bulla birostris* Linnaeus, 1767. Recent, Indo-Pacific.

1817. *Radius* Schumacher, Ess. nouv. syst., p. 259. Type species by M *R.brevirostris*
 Schumacher, 1817 = *Bulla birostris* Linnaeus, 1767 (non *Radius* Montfort, 1817).

Shell slender and fusiform, extremities produced into short or long and slender canals, aperture narrow or wide, dilated anteriorly, labial teeth obsolete or absent, columella smooth, fossula narrow or absent.

Species of *Phenacovolva* have a less ventricose body whorl in comparison to *Volva* s.str., and the dorsal spiral sculpture is often visible only at the extremities.

Volva (Phenacovolva) longirostrata (Sowerby, 1828)

— *Volva birostris* auctt. (non Linnaeus, 1767).

1828. *Ovulum longirostratum* Sowerby, Zool. Journ. 4:160.
 1830. *Ovulum longirostratum* Sowerby, Spec. Conch. Mon. *Ovulum* 1(1): pl. 2, figs. 46-48.
 1848. *Ovulum recurvum* Adams & Reeve, Voy. Samarang, pl. 21, pl. 6, figs. 3a-c.
 1855. *Ovulum longirostratum* Sowerby, Thes. Conchyl. 2:481, pl. 100, figs. 59,60.
 1865. *Ovulum longirostratum* Sowerby, Reeve. Conch. Icon. 15:pl. 3, figs. 40a-c.
 1932. *Volva birostris* Linnaeus, Schilder, Proc. Malac. Soc. Lond. 20(1): 56,62, pl. 5, fig. 78
 (non *Bulla birostris* Linnaeus, 1767).
 1966. *Phenacovolva birostris* (Linné), Habe & Kosuge, Shells world col. 2:37, pl. 13, fig. 1
 (non *Bulla birostris* Linnaeus, 1767).
 1966. *Volva longirostrata* (Sowerby), Schilder, Veliger 9(2): 98-99.

TYPE LOCALITY: None.

Schilder (1966) in his report on the Linnaean types of Cypraeidae, remarked on the presence of 2 different species in the Linnaean collection, i.e. *Volva brevirostris* (Schumacher,1817) and *V.longirostrata* (Sowerby,1882). That author pointed out that only the specimen of *V.brevirostris* corresponded to Linnaeus' description; this specimen was considered to be the holotype of *V.birostris* (Linnaeus). Authors following Schilder's findings will have to substitute *V.birostris* (Linnaeus) for *V.brevirostris* (Schumacher) and *V.longirostrata* (Sowerby) for *V.birostris* auctt. Authors disagreeing with Schilder's type selection should consider the Linnaean *Bulla birostris* to be a *nomen dubium* in view of the presence of two different species in the type collection; in this particular case *Volva longirostrata* (Sowerby) would still remain the taxon applicable to the species recorded from New Zealand.

Volva recurva (Adams & Reeve) from the China Seas appears to belong to *V.longirostrata* and no *V.birostris*. The species is very slender (width 23% of length) the canals are produced, slender and recurved, the shell is white and tinged with buff and no denticles are visible on the labial lip, and the funiculum is absent.

Several specimens of *V.longirostrata* were taken by divers at the Poor Knights Islands on primnoidean gorgonians at 150 ft (46 m) depth. In New Zealand specimens the spiral striae are visible along the whole length of the dorsum, and one specimen was streaked with orange on the columella. For further details see Powell (1971, this volume).

Genus *Simnia* Risso, 1826

Simnia Risso, 1826, Hist. nat. L'Eur. Merid. 4:235. Type species by SD (Gray, 1847) *S.nicaeensis* Risso, 1826. Recent, Mediterranean.

1884. *Neosimnia* Fischer, Man. Conchyl., p. 664. Type species by M *O.spelta* Linne = *Bulla spelta* Linnaeus, 1758. Recent, Mediterranean.

Shell small, 10-30 mm, slender and elongate, extremities shorter than in *Volva* Röding; dorsum with or without a dorsal carina. Aperture narrow, widening anteriorly, labial lip narrow, flat or convex, reflected or inflected, teeth obsolete or absent, columella rounded, edentulous, and occasionally longitudinally keeled; fossula narrow or obsolete, funiculum obsolete.

Simnia sp.

(Fig. 19)

One specimen 11.0 mm in length and 3.6 mm in width, from Altonian deposits (L.Miocene) of Kaipara Harbour, has been examined. The aperture is narrow but dilated anteriorly, the labial lip is narrow, flat, edentulous and inflected; part of the extremities are missing. The dorsum has an obsolete but distinguishable dorsal transverse carina in the posterior quarter; the columella is smooth and longitudinally keeled, and the fossula is narrow and smooth.

The small size, short extremities, dorsal carina and narrow fossula, indicate a placement of the new species in *Simnia* rather than the volvine subgenus *Phenacovolva* Iredale. The new species will be described in detail by Mr. J. A. Grant-Mackie, in a future evaluation of the Altonian fauna of Kaipara Harbour.



Fig. 19. *Simnia* sp. Kaipara Harbour, L. Miocene. Geol. Dept. Univ. Auckl.; length 11.0mm.

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